PRBO Conservation Science

Publication Brief

Release:	***Contact***:	***Phone***:	***E-mail***:
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Predicting Tidal Marsh Bird Abundance Using Fine-Scale Spatial Metrics

A new paper in the journal *Wetlands* highlights the utility of spatial predictive models in tidal marsh restoration and monitoring efforts. By developing models for three species based on high-resolution aerial imagery and field-based bird surveys, the authors were able to evaluate the benefits and limitations of different approaches and assess the value of each species as an indicator of ecological condition.

The research was conducted as part of an interdisciplinary wetland project focusing on the north San Francisco Bay and Delta (Integrated Regional Wetland Monitoring, www.irwm.org) funded by the CALFED Bay/Delta Program. In collaboration with remote-sensing scientists at UC Berkeley (kellylab.berkeley.edu/), PRBO biologists developed a suite of spatial metrics describing patterns in marsh vegetation and geomorphology for six sites across a steep salinity gradient (four restored and two reference marshes). These metrics can be used to explain variation in abundance of tidal marsh birds.

The set of metrics included those based on color infrared aerial imagery, such as NDVI (the normalized difference vegetation index), which indicates above-ground vegetation productivity, as well as those from detailed species-specific vegetation maps derived from the imagery. These metrics were used to develop fine-scale spatial models of avian habitat suitability for three tidal-marsh-endemic subspecies of special concern: Salt Marsh Common Yellowthroat (*Geothlypis trichas sinuosa*), Suisun and San Pablo Song Sparrow (*Melospiza melodia maxillaris* and *M. m. samuelis*), and California Black Rail (*Laterallus jamaicensis coturniculus*). In each case, the best predictive models included both vegetation-map metrics and metrics directly extracted from aerial imagery, such as NDVI and channel density. Thus, each type of metric provides unique information to help assess habitat suitability. Nevertheless, the remotely sensed metrics demonstrated superior value, offering high benefit relative to their low cost.

Our models suggested that the use of these species as indicators of marsh condition may vary according to the spatial scale: local level for Song Sparrow, site level for Common Yellowthroat, and local to site level for Black Rail.

As high-resolution, multispectral aerial imagery becomes more readily available, our methods may be applied to a diverse range of sites, resulting in more robust and generalizable models that can be used to map current avian habitat suitability and monitor changes over time.

Field Code Changed

Management Implications

- Although remote sensing cannot replace on-the-ground monitoring, it can help assess habitat suitability efficiently, especially for large sites with limited accessibility.
- Through the application of spatial predictive models, aerial imagery and vegetation maps can be used to extend the value of field-survey data.
- Spectrally derived metrics such as NDVI and channel characteristics, which are easier to generate than classified vegetation maps, may also be better and cheaper indicators for bird habitat.

Stralberg, D., M. Herzog, N. Nur, K. Tuxen, and M. Kelly. 2010. Predicting avian abundance within and across tidal marshes using fine-scale vegetation and geomorphic metrics. *Wetlands* 30:475-487. doi:10.1007/s13157-010-0052-8